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the earth carry down the molecules of lime in a ceaseless current with the common sea, where says Dana "after circulating over thousands of miles and for unknown times, they are brought to light and rendered tangible again by the incessant labors of millions of minute living gelatinous bodies, and by these insignificant organisms the lime is built up again into masses almost rivalling the original in dimensions and importance, but losing in this, its new dress, all traces of its divine origin and divine age." Thus he says, "we may have rocks from the snow-covered summits of the Himalayas, the limestones of the burning plains of India, and the strata of inaccessible China, removed from their respective districts—into the great common receptacle."

Modern science teaches that the small has produced the great, that the earth as we now know it has been fashioned by forces which are in operation to-day. The small indeed may be the most significant, and size in the vocabulary of biology at least may be an unimportant term.

SOLENIUS: ITS GENERIC CHARACTERS AND RELATIONS.

BY CHARLES R. KEYES.

THE genus *Soleniscus* was established by Meek and Worthen to include gastropod shells closely allied to the widely known *Macrocheilus*; and said to be distinguished from the latter chiefly by the presence of a single elevated fold on the columella and by being produced anteriorly into a short canal. The authors described under this genus but a single species—*S. typicus*. Miller,¹ however, in 1877, included also *Macrocheilus hallanus* Geinitz. Four years later White² described from New Mexico *S. planus* and *S. brevis*; and afterwards³ referred to the genus five other species which had orig-

¹ Am. Palæ. Foss., p. 162.

² Exp. and Sur. west 100th Merid., Supp. to Vol. iii.

³ Ind. Geol. Rep. for 1883.

inally been placed under *Macrocheilus*. Upon the characters mentioned, principally, *Macrocheilus* and *Soleniscus* have been separated. The former was considered to embrace all the Devonian and a few of the Carboniferous forms described under the genus; and the latter the majority of the American Carboniferous species, generally known under the other generic title.

Of *Macrocheilus* there have been described from Europe nearly fifty species; two-fifths of which are from the Devonian. From America thirty-four species have been named; of these five are from the Devonian, three from the Lower Carboniferous and the rest from the Coal Measures. The American Devonian forms are exceedingly rare; and nothing beyond the original descriptions is known in regard to them. With one exception, they have been, in all probability, erroneously referred to the genus. The species described from the Carboniferous of North America will doubtless be reduced, after a careful comparison, to one-half the number now recognized.

Macrocheilus was founded by Phillips¹ in 1841, and under it were enumerated *Buccinum breve* Sow., *B. imbricatum* Phillips, *B. acutum* Sowerby and three other species. Phillips, however, expressly remarked that the first two of these properly belong to other groups, and that he regarded the third form as more typical. *B. acutum* Sow. hence becomes the type of the genus; and was thus considered by de Koninck and other European writers. An examination of numerous specimens of *Macrocheilus* (*Buccinum*) *acutum* shows that the shell possesses a more or less thickened lip, and a prominent revolving fold on the columella. De Koninck² long ago recognized this fact, stating that "La columelle est garnie d'un pli oblique et quelquefois de deux; le second pli n'est que faiblement exprimé et ne s'observe bien que dans les échantillons d'une conservation parfaite." It thus appears that the form described as *Buccinum acutum* by Sowerby is in all respects a typical *Soleniscus* and that therefore that genus and *Macrocheilus* are identical.

¹ Palæ. Foss. Cornwall, p. 103.

² Desc. des Anim. Foss. de Belgique, p. 474. 1844.

But Phillip's term *Macrocheilus* was preoccupied by Hope, in 1838, for a genus of insects and therefore becomes unavailable. Conrad, in 1842, proposed *Plectostylus* for a group of fossil gastropods which evidently belonged to *Macrocheilus*; but this name also had been used by Beck five years before. In 1860, Meek and Worthen founded the genus *Soleniscus*, for certain paleozoic shells which now appear to be very closely related to the type of *Macrocheilus*. Inasmuch as the latter term had been previously used, Bayle, in 1879, substituted the name *Duncania*, which he subsequently¹ changed to *Macrochilina*. The generic title *Soleniscus* therefore takes precedence for the *Macrocheilus* group, typified by *Buccinum acutum* Sow., and *S. typicus* M. and W., the synonymy being as follows:

Buccinum Sowerby, etc., [*in part*] (*non* Linné).

1841. *Macrocheilus* Phillips. *Palæ. Foss. Corn.*, p. 103. (*non* Hope, 1838, *Coleoptera*).

1842. *Plectostylus* Conrad. *Jour. Acad. Nat. Sci.*, Phila., Vol. viii, p. 275. (*non* Beck, 1837).

1860. *Soleniscus* Meek and Worthen. *Proc. Acad. Nat. Sci.*, Phila., 1860. p. 467.

1879. *Duncania* Bayle. *Jour. de Conchyliologie*, Vol. xix., p. 35.

1880. *Macrochilina* Bayle. *Ibid.*, Vol. xx., p. 241.

If the assumed differences in certain characters of the Devonian and earlier Carboniferous species described under *Macrocheilus* are real, and are of sufficient import to separate generically this group from *Soleniscus*, as has been suggested, some other generic term must be employed to designate the group. In this case, Bayle's name *Macrochilina* might easily be made to answer; but it is very doubtful whether this would be expedient. A more advisable plan would be to transfer to other genera the several species described under *Macrocheilus*, but which perhaps do not properly belong there. In this way it is thought that *Soleniscus* will form naturally a very compact and easily distinguishable group, at least in so far as the American species are concerned, and apparently also the European.

Soleniscus consequently embraces paleozoic gastropods

¹ *Jour. de Conchyliologie*, (3), Vol. xx., p. 241. 1880.

having the shell fusiform or subovoid ; the spire always acute ; body whorl relatively rather large ; aperture suboval, rounded anteriorly, angular behind ; labrum thin ; columella imperforate, and provided with a more or less distinct fold ; surface smooth.

As observed by White, the twisted ridge on the columella is scarcely discernible in the perfect shell until the outer lip is broken away, when it is seen to become more and more pronounced as it passes inward from the aperture. By the removal of the lip the anterior portion of the shell seems more extended than in the unbroken specimen ; and this feature was made unduly conspicuous by Meek and Worthen when they established the genus under consideration. Although seldom noticed on account of the apertural part of the shell being filled with matrix, a more or less well defined columellar fold is observable in the most of the hitherto called *Macrocheili*. This plication, very slightly developed in some forms, passes, in the various species, by imperceptible gradations into a conspicuous revolving ridge as exhibited in *S. typicus*. The callus of the inner lip varies so greatly, according to the state of preservation and the locality, that only in a general way can it be relied upon as of generic importance.

The following species, originally described as *Macrocheili* may be considered as properly belonging to *Soleniscus* :

<i>S. typicus</i> M. & W.	<i>S. (?) attenuatus</i> Hall.
<i>S. acutus</i> Sow.	<i>S. gracilis</i> Cox.
<i>S. humilis</i> Keyes.	<i>S. klipparti</i> Meek.
<i>S. kansasensis</i> Swallow.	<i>S. altonensis</i> Worthen.
<i>S. hallanus</i> Geinitz.	<i>S. newberryi</i> Stevens.
<i>S. planus</i> White.	<i>S. paludinaformis</i> Hall.
<i>S. brevis</i> ¹ White.	<i>S. carinatus</i> Stevens.

With two or three exceptions, perhaps, the other described species of the fusiform group from the American Carboniferous are apparently synonymous with one or another of those here enumerated. The genus probably includes besides *S. acutus*

¹ *S. brevis* White is synonymous with *Macrocheilus ventricosum* Hall, but the latter was preoccupied by Goldfuss (*Pet. Germ., Dritter Theil*, p. 29, 1841-44).

Sow. the majority of European forms now known under Bayle's *Macrochilina*.

In America, *Soleniscus* is one of the most characteristic genera of the Upper Carboniferous. The forms fall naturally into two categories: (a) the elongate or fusiform shells; and (b) the subovoid or subglobose varieties.

Those of the first group predominated in the earlier part of the epoch, while those of the second were more abundant in the latter part. The fusiform species occur most plentifully in the bituminous shales immediately associated with the coal seams. This would indicate that these gastropods were marsh or brackish-water forms, rather than denizens of the open sea. The subovoid forms are more commonly found in calcareous strata and were probably more strictly marine than the other members of the genus. Aside from the apparent difference in *optimum habitat* the shells of the two sections present some distinctive structural features which, taking all things into consideration, may eventually warrant a generic separation. This might with advantage be done with the American species, but whether it could be satisfactorily applied to the numerous foreign forms has not, as yet, been determined. The shells of the first category, compared with those of the second, have the volutions much more convex, the spire greatly depressed, the body whorl relatively much larger, and the aperture correspondingly ample, while the columellar ridge is usually obtuse and sometimes scarcely defined.

EXPLANATION OF PLATE XX.

Figs. 1, 2, 3. *Soleniscus acutus* Sow. 4. *S. humilis* Keyes. 5. *S. newberryi* ? Stevens. 6. *S. gracilis* Cox. 7. *S. attenuatus* Hall. 8. *S. typicus* M. & W. 9. *S. attenuatus* ? Hall. 10. *M. primogenium* Conrad. 11. *S. klipparti* Meek. 12, 14. *S. brevis* White. 13. *M. intercalare* M. & W. 15. *M. ponderosum* Swallow. 16. *S. paludinæformis* Hall. 17. *M. texanum* ? Shumard. 18. *S. planus* White. Last five after White.